[JP,08-326590,A] machine translation

CLAIMS

[Claim(s)]

[Claim 1] It is based on an input signal from the sensor for engine operational status detection arranged in each part containing the revolution sensor which detects an engine rotational frequency, and the coolant temperature sensor which detects an engine circulating water temperature. In the internal combustion engine constituted so that the amount of fuel supply from a fuel supply system to an engine might be adjusted A fault detection means to detect failure of said coolant temperature sensor, and an engine condition distinction means to distinguish whether you are an engine at the start-up time, or it is after start up, While switching [from said revolution sensor, and a coolant temperature sensor fault detection means and an engine condition distinction means] the input value from a coolant temperature sensor to the set point based on the detecting signal and distinction signal which are outputted, respectively at the time of start up at the time of the coolant temperature sensor failure at the time of engine start up At the time of the start up which amends the set point from immediately after [the] to the value put close to the set point after start up of the minute after [water temperature amendment / every / warming-up] water temperature asked for every fuel supply and every fixed time amount from the amount of fuel supply and engine rotational frequency at the time of an idling at the time of said start up, a water temperature setting-out means, It is based on the detecting signal and distinction signal which are outputted from said fault detection means and an engine condition distinction means, respectively. The water temperature setting-out means after start up which performs said amendment in case the water temperature before failure is said under after [start up] set point, and is switched to the set point after start up in the case of [beyond the after / start up / set point] at the time of the coolant temperature sensor failure after engine start up, The fail-safe system at the time of the coolant temperature sensor failure in the internal combustion engine characterized by consisting of ******.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the fail-safe system at the time of the coolant temperature sensor failure in an internal combustion engine.

[0002]

[Description of the Prior Art] When failure of a sensor etc. is detected while it is constituted based on the input signal from the sensor arranged in each part so that the fuel oil consumption from a fuel injection equipment may be adjusted according

to engine operational status, he is trying to transpose the input signal to a moderate default reading in the automobile engine equipped with the electronics control type fuel injection equipment.

[0003] For example, when failure of the coolant temperature sensor which detects an engine's circulating water temperature is detected, it transposes to the set point equivalent to the circulating water temperature after warming up the input value from a coolant temperature sensor, and is made possible [migration of a car] within a need limit. By the way, as conventionally shown in JP,60-240842,A, when failure of a coolant temperature sensor is detected, the signal of the intake-air temperature detected by the intake temperature sensor is temporarily used as a default reading of a circulating water temperature, and the thing which he is trying to transpose to the set point equivalent to the circulating water temperature after warming up after predetermined time progress is known.

[0004] However, if it is in such a conventional technique, when a coolant temperature sensor breaks down at the time of car transit, migration of a car is possible, but when failure of a coolant temperature sensor is detected at the time of restart once stopping an engine, or engine start up, there are the following problems. That is, according to what was fixed to the default reading made to correspond to the stability water temperature after warming up the default reading at the time of coolant temperature sensor failure, at the time of engine start up, since loading amendment of the fuel oil consumption corresponding to a circulating water temperature is hardly performed, fuel oil consumption decreases, an engine does not start or start up becomes difficult.

[0005] Since such nonconformity is canceled, it is possible to set the default reading of a circulating water temperature as a low value only at the time of start up, but in this case, since the actual injection quantity increases extremely to an engine's demand injection quantity at the time of elevated-temperature restart, start up becomes difficult by smoking of an ignition plug etc. Furthermore, like the above-mentioned conventional technique, if an intake-air temperature signal is transposed to the default reading of a water temperature signal, since an intake-air temperature rises to an elevated temperature comparatively, in the case of an engine with a supercharger etc., it will be difficult to acquire too much signal equivalent to a circulating water temperature, and it will become difficult to perform fuel injection according to an engine condition.

[0006] Then, as indicated by JP,1-100346,A, when it is judged with it being an engine at the start-up time, the input value from a coolant temperature sensor is made into the set point at the time of start up. While amending fuel oil consumption based on the value which brought the set point close to the minute set point after water temperature amendment [every] start up for every fuel injection and every fixed time amount at the time of this start up When judged with it being after an engine's starting, the input value from a coolant temperature sensor is made into the set point after start up, and the technique which amended fuel oil consumption based on the set point after this start up is proposed.

[0007]
[Problem(s) to be Solved by the Invention] However, if it is in the above conventional techniques, fluctuation of the warming-up time amount by condition change of an OAT etc. cannot be coped with, and amendment of fuel oil consumption cannot be performed. Moreover, in order to perform fixed amendment, depending on a service condition, we are anxious about aggravation of engine operability.
[0008] Furthermore, in order to judge it as the warming-up back also about the coolant temperature sensor failure immediately after start up, aggravation of operability arises. Then, as this invention can also cope with fluctuation of the warming-up time amount by condition change of an OAT etc., while it enables suitable amendment of the amount of fuel supply in view of the above conventional troubles in the fail-safe system at the time of the coolant temperature sensor failure in an internal combustion engine, it aims at not depending on a service condition but aiming at improvement in operability.
[0009]
[Means for Solving the Problem] For this reason, the revolution sensor by which invention concerning claim 1 detects an engine rotational frequency as shown in drawing 1 , In the internal combustion engine constituted based on the input signal from the sensor for engine operational status detection arranged in each part containing the coolant temperature sensor which detects an engine circulating water temperature so that the amount of fuel supply from a fuel supply system to an engine might be adjusted A fault detection means to detect failure of said coolant temperature sensor, and an engine condition distinction means to distinguish whether you are an engine at the start-up time, or it is after start up, While switching [from said revolution sensor, and a coolant temperature sensor fault detection means and an engine condition distinction means] the input value from a coolant temperature sensor to the set point based on the detecting signal and distinction signal which are outputted, respectively at the time of start up at the time of the coolant temperature sensor failure at the time of engine start up At the time of the start up which amends the set point from immediately after [the] to the value put close to the set point after start up of the minute after [water temperature amendment / every / warming-up] water temperature asked for every fuel supply and every fixed time amount from the amount of fuel supply and engine rotational frequency at the time of an idling at the time of said start up, a water temperature setting-out means, It is based on the detecting signal and distinction signal which are outputted from said fault detection means and an engine condition distinction means, respectively. At the time of the coolant temperature sensor failure after engine start up, when the water temperature before failure was said under after [start up] set point, said amendment was performed, and it constituted including the water temperature setting-out means after start up switched to the set point after start up in the case of [beyond the after / start up / set point].
[0010]
[Function] In invention concerning claim 1, if it is at the engine start-up time when

failure of a coolant temperature sensor is detected, the input output of a coolant temperature sensor will be switched to the set point at the time of start up. And based on each minute correction value which is calculated for every fuel supply and every fixed time amount from the amount of fuel supply and engine rotational frequency at the time of an idling and which was gradually increased until it was water-temperature-amendment[every]-added and the correction value after the addition reached the set point after start up of after [warming-up] water temperature, the amount of fuel supply for every time will calculate from immediately after [the] to the set point at the time of said start up. Namely, since an amended part corresponding to a circulating water temperature changes gradually until an engine starts from the set point at the time of the start up made equivalent to the cooling water temperature at the time of the start up at the time of the usual fuel control, The amount of fuel supply supplied to a combustion chamber by the fuel supply system While decreasing to the Lean side gradually from the amount of fuel supply at the time of the usual start up, and an unchanging rich mixture, and also being able to cope with now fluctuation of the warming-up time amount by condition change of an OAT etc. and attaining amendment of the amount of fuel supply, there is also no concern to which engine operability gets worse according to a service condition.

[0011] On the other hand, since said amendment is performed in case the water temperature before failure is said under after [start up] set point, and it will be switched to the set point after start up in case it is beyond the after [start up] set point if it is coolant temperature sensor failure after engine start up, its weight is reduced by extent which can move a car, and the amount of fuel supply from a fuel supply system can rationalize the amount of fuel supply etc., and does not have a possibility that aggravation of operability may arise.

[0012]

[Example] Hereafter, with reference to the attached drawing, this invention is explained in full detail. Drawing 2 shows the Diesel engine for automobiles roughly. In this drawing, the electronics control type fuel injection pump 2 as a fuel supply system with which the engine 1 was equipped The below-mentioned crank angle sensor 3 as a revolution sensor which detects an engine rotational frequency, Based on the input signal from the sensor for engine operational status detection arranged in each part containing the coolant temperature sensor 4 which detects an engine circulating water temperature, it is constituted so that the fuel oil consumption to an engine 1 may be adjusted, and the control unit 5 which controls actuation of this fuel injection pump 2 is formed.

[0013] Said crank angle sensor 3 is formed corresponding to the body of revolution 6 which acts synchronizing with a crankshaft. Said coolant temperature sensor 4 is set up so that an analog electrical signal may be outputted according to an engine circulating water temperature. This output signal is changed into a digital electrical signal through an A/D converter while it is inputted into a control unit 5.

[0014] Said crank angle sensor 3 outputs the signal corresponding to an engine's 1

rotational speed, and this output signal is inputted into a control unit 5 as a pulse signal. A control unit 5 is constituted including arithmetic and program control 7, storage 8, and close and the output interface 9 and 10 grades. The signal from a coolant temperature sensor 4, and the signal from the crank angle sensor 3 and the signal from other sensors are inputted into the input interface 9, and an injection signal is outputted to it towards a fuel injection pump 2 from the output interface 10.

[0015] A fault detection means to detect failure of a coolant temperature sensor 4 to said control unit 5 here, An engine condition distinction means to distinguish whether you are an engine 1 at the start-up time, or it is after start up, While switching [from said revolution sensor 3, a fault detection means, and an engine condition distinction means] the input value from a coolant temperature sensor 4 to the set point based on the detecting signal and distinction signal which are outputted, respectively at the time of start up at the time of the coolant temperature sensor failure at the time of engine start up At the time of the start up which amends the set point from immediately after [the] to the value put close to the set point after start up of the minute after [water temperature amendment / every / warming-up] water temperature asked for every fuel injection and every fixed time amount from the fuel oil consumption and the engine rotational frequency at the time of an idling at the time of said start up, a water temperature setting-out means, It is based on the detecting signal and distinction signal which are outputted from said fault detection means and an engine condition distinction means, respectively. At the time of the coolant temperature sensor failure after engine start up, in case the water temperature before failure is said under after [start up] set point, said amendment is performed, and the software target is equipped with each function of the water temperature setting-out means after start up, and ** switched to the set point after start up in the case of [beyond the after / start up / set point], respectively.

[0016] The content of control of this control unit 5 is explained based on the flow chart of drawing 3 . First, the step 1 (it is written as S1 by a diagram.) the following -- being the same -- it sets, the water sympathy news from a coolant temperature sensor 4 is inputted, and it progresses to step 2. At this step 2, it judges whether based on the water sympathy news inputted serially, the coolant temperature sensor 4 is operating normally. If failure of a coolant temperature sensor 4 is distinguished and it is not detected when the failure decision value set up beforehand is specifically detected continuously more than the count of predetermined, it distinguishes that it is normal. When judged with failure, it progresses to step 3. At step 3, if it judges whether it has judged at the time of start up and has not judged at the time of start up, it progresses to step 4 and judges whether it is at the engine start-up time, or it is after start up based on the engine rotational frequency obtained from the crank angle sensor 3. If judged with it being at the start-up time, it will progress to step 5, and if judged with it being after start up, it will progress to step 6.

[0017] In the step 5 after being judged with the time of start up at step 4, the input

value Tw from a coolant temperature sensor 4 is progressed to the set point KTw1 (for example, 40-degreeC) at a switch (Tw=KTw1) and step 7 at the time of start up. At this step 7, although the set point Tw (= KTw1) is compared with the set point KTw2 (for example, 80-degreeC) after start up at the time of said switched start up, since it is KTw1<KTw2, it progresses to step 8. every [which is asked for the set point Tw (= KTw1) for every fuel injection and every fixed time amount at this step 8 from the fuel oil consumption and the engine rotational frequency at the time of an idling at the time of said start up / minute water temperature amendment part deltaTw] -- it is set as the value put close to the set point after start up of after [warming-up] water temperature (Tw=Tw+delta Tw).

[0018] On the other hand, in the step 6 after being judged with the start-up back at step 4 (i.e., after being judged with the time of the failure after start up), it progresses to the coolant temperature sensor output value Tw1 before breaking down the input value Tw from a coolant temperature sensor 4 at a switch (Tw=Tw1) and step 7. At this step 7, the coolant temperature sensor output value Tw (= Tw1) before said switched failure is compared with the set point KTw2 after start up, in case the water temperature before failure is said under after [start up] set point, amendment progressed and mentioned above to (Tw<KTw2) and step 8 is performed, and it progresses to (Tw>=KTw2) and step 9 in the case of [beyond the after / start up / set point], and switches to the set point KTw2 after start up.

[0019] Moreover, when judged with having judged at step 3 at the time of start up, it progresses to the direct step 7. In addition, the above control is an interruption routine for every fixed period, and the calculation result is used in case fuel oil consumption is computed in a main routine. Here, the amendment approach of step 8 is explained.

[0020] At this step 8, as mentioned above, the set point is set as the value put close to the set point after start up of the minute after [water temperature amendment / every / warming-up] water temperature asked for every fuel injection and every fixed time amount from the fuel oil consumption and the engine rotational frequency at the time of an idling at the time of start up. That is, based on the idle rpm of A or B as shown in drawing 4 , the dip of the criteria property of the anticipation water temperature accompanying the time amount progress from the start up shown in drawing 5 is amended like a or b.

[0021] According to this configuration, the input output of a coolant temperature sensor 4 is switched to the set point at the time of start up at the time of the coolant temperature sensor failure at the time of engine start up. And based on each minute correction value which is calculated for every fuel injection and every fixed time amount from the fuel oil consumption and the engine rotational frequency at the time of an idling and which was gradually increased until it was water-temperature-amendment[every]-added and the correction value after the addition reached the set point after start up of after [warming-up] water temperature, the fuel oil consumption for every time will calculate from immediately after [the] to the set point at the time of said start up. That is, since

an amended part corresponding to a circulating water temperature changes gradually until an engine starts from the set point at the time of the start up made equivalent to the cooling water temperature at the time of the start up at the time of the usual fuel control, the fuel oil consumption supplied to a combustion chamber by the fuel injection pump will decrease to the Lean side gradually from as unchanging a rich mixture as the fuel oil consumption at the time of the usual start up.

[0022] On the other hand, since said amendment is performed in case the water temperature before failure is said under after [start up] set point, and it will be switched to the set point after start up in case it is beyond the after [start up] set point if it is coolant temperature sensor failure after engine start up, the quantity of the fuel oil consumption by the fuel injection pump is decreased by extent which can move a car. Therefore, according to this configuration, when the abnormalities of a coolant temperature sensor are detected at the time of engine start up, the amount of fuel supply can suit an engine situation in the broad field of the time of start up between the colds to the time of warming-up start up, and an engine can be started certainly. And when the abnormalities of a coolant temperature sensor arise after engine start up, the fuel of extent to which a car may be moved can be supplied to a combustion chamber.

[0023] According to this configuration, especially at the time of failure of a coolant temperature sensor and an engine's start up The result of having amended [immediately after switching the input value from a coolant temperature sensor to the set point at the time of start up] the set point from from to the value put close to the set point after start up of the minute after [water temperature amendment / every / warming-up] water temperature asked for every fuel injection and every fixed time amount from the fuel oil consumption and the engine rotational frequency at the time of an idling at the time of start up, While also being able to cope with now fluctuation of the warming-up time amount by condition change of an OAT etc. and attaining amendment of fuel oil consumption, there is also no concern to which engine operability gets worse according to a service condition.

[0024] Furthermore, at the time of the failure after engine start up, since said amendment is performed and it was made to switch to the set point after start up in the case of [beyond the after / start up / set point] when the water temperature before failure was under the after [start up] set point, also about the coolant temperature sensor failure immediately after start up, fuel oil consumption etc. can be rationalized and there is no possibility that aggravation of operability may arise.

[0025]

[Effect of the Invention] As explained above, when the abnormalities of a coolant temperature sensor are detected at the time of engine start up according to invention concerning claim 1, the amount of fuel supply suits an engine situation in the broad field of the time of start up between the colds to the time of warming-up start up. While being able to start an engine certainly, when the abnormalities of a coolant temperature sensor arise after engine start up The fuel of extent to which a car may be moved can be supplied to a combustion chamber. Especially While also

being able to cope with now fluctuation of the warming-up time amount by condition change of an OAT etc. and attaining amendment of the amount of fuel supply at the time of failure of a coolant temperature sensor and an engine's start up According to a service condition, the concern to which engine operability gets worse is also lost, also about the time of the coolant temperature sensor failure immediately after start up, the amount of fuel supply etc. can be rationalized and improvement in operability can be aimed at.

FAIL SAFE SYSTEM AT FAILURE OF COOLANT TEMPERATURE SENSOR IN INTERNAL COMBUSTION ENGINE

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Applicant(s): NISSAN MOTOR CO LTD
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Equivalents:

Abstract

PURPOSE: To prevent worsening of engine operability by a method wherein when a coolant temperature before the occurrence of a trouble exceeds a set value after starting during failure in operation of a water temperature sensor after the starting of an engine, the water temperature is switched to a set value after starting.
CONSTITUTION: In a control unit 5 to input an output signal from an engine operation state detecting sensor containing a crank angle sensor 3 and a water temperature sensor 4, when failure in operation of the water temperature sensor 4 is detected, if the trouble is detected after the starting of an engine, the input value of the water temperature sensor 4 is switched to a set value during starting. From right thereafter, a micro water temperature correction content at a time determined from a fuel feed amount and the number of revolutions of an engine during idling each time fuel is fed or at intervals of a specified time is added to a set value during starting. Until a correction amount after addition attains a set value after starting equivalent to a coolant temperature after warming up, a fuel feed amount at each time is computed based on each correction value gradually increased and a fuel injection pump 2 is controlled. This constitution prevents the worsening of engine operability in spite of failure in operation of the water temperature sensor 4.

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	45/00	３１２			45/00	３１２Ｑ
		３６０				３６０Ｂ
						３６０Ｄ

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(71)出願人　000003997
日産自動車株式会社
神奈川県横浜市神奈川区宝町２番地

(72)発明者　阿部　敦祐
神奈川県横浜市神奈川区宝町２番地　日産自動車株式会社内

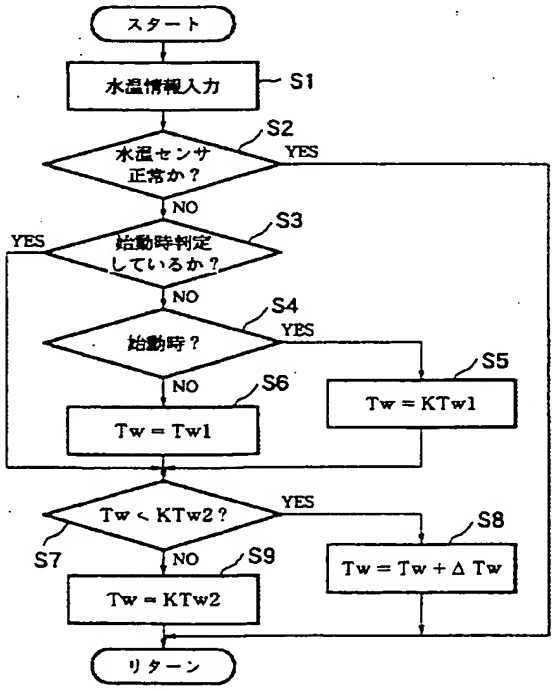
(74)代理人　弁理士　笹島　富二雄

(54)【発明の名称】　内燃機関における水温センサ故障時のフェイルセーフシステム

(57)【要約】

【目的】　水温センサのフェイルセーフシステムにおいて、燃料供給量の適切な補正を可能にすると共に、運転条件に依らず運転性の向上を図ることを目的とする。

【構成】　Ｓ４にて始動時と判定された後のＳ５においては、水温センサからの入力値Ｔｗを始動時設定値ＫＴｗ１に切り換え、Ｓ７に進んで、Ｔｗ（＝ＫＴｗ１）と始動後設定値ＫＴｗ２とを比較するが、ＫＴｗ１＜ＫＴｗ２であるから、Ｓ８に進む。このＳ８では、Ｔｗ（＝ＫＴｗ１）を燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ΔＴｗずつ暖機後水温相当の始動後設定値に近づけた値に設定する。一方、Ｓ４にて始動後と判定された後、即ち、始動後の故障時と判定された後のＳ６においては、入力値Ｔｗを故障前の水温センサ出力値Ｔｗ１に切り換え、Ｓ７に進んで、Ｔｗ（＝Ｔｗ１）とＫＴｗ２とを比較し、故障前の水温が始動後設定値未満の際には、Ｓ８に進んで前述した補正を実行し、始動後設定値以上の際には、Ｓ９に進んで始動後設定値ＫＴｗ２に切り換える。



【特許請求の範囲】
【請求項１】機関回転数を検出する回転センサと、機関冷却水温度を検出する水温センサとを含む各部に配設した機関運転状態検出用のセンサからの入力信号に基づいて、燃料供給装置から機関への燃料供給量を調節するように構成された内燃機関において、
前記水温センサの故障を検出する故障検出手段と、
機関が始動時であるか始動後であるかを判別する機関状態判別手段と、
前記回転センサと、水温センサ故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判別信号に基づいて、機関始動時の水温センサ故障時に、水温センサからの入力値を始動時設定値に切り換えると共に、その直後から前記始動時設定値を燃料供給毎若しくは一定時間毎にアイドリング時の燃料供給量と機関回転数とから求められる微小な水温補正分ずつ暖機後水温相当の始動後設定値に近づけた値に補正する始動時水温設定手段と、
前記故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判別信号に基づいて、機関始動後の水温センサ故障時に、故障前の水温が前記始動後設定値未満の際に前記補正を実行し、始動後設定値以上の際に始動後設定値に切り換える始動後水温設定手段と、
を含んで構成されたことを特徴とする内燃機関における水温センサ故障時のフェイルセーフシステム。

【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、内燃機関における水温センサ故障時のフェイルセーフシステムに関する。
【０００２】
【従来の技術】電子制御式燃料噴射装置を備えた自動車用内燃機関においては、各部に配設したセンサからの入力信号に基づいて、燃料噴射装置からの燃料噴射量を機関運転状態に応じて調節するように構成されていると同時に、センサ等の故障が検出された際には、その入力信号を適度な代替値に置き換えるようにしている。
【０００３】例えば、機関の冷却水温度を検出する水温センサの故障が検出された場合には、水温センサからの入力値を暖機後の冷却水温度に相当する設定値に置き換えて、必要限度内で車両の移動が可能となるようにしている。ところで、従来、特開昭６０－２４０８４２号公報に示されるように、水温センサの故障が検出された場合には、吸気温センサにより検出される吸気温度の信号を冷却水温度の代替値として一時的に利用し、所定時間経過後に暖機後の冷却水温度に相当する設定値に置き換えるようにしているものが知られている。
【０００４】しかし、このような従来技術にあっては、車両走行時に水温センサが故障した場合には、車両の移動が可能であるが、一旦機関を停止させた後の再始動時、或いは機関始動時に水温センサの故障が検出された場合には、次のような問題がある。即ち、水温センサ故障時の代替値を暖機後の安定水温に対応させた代替値に固定したものによると、機関始動時には、冷却水温度に対応する燃料噴射量の増量補正が殆ど行われないため、燃料噴射量が少なくなって、機関が始動しなかったり、始動が困難となる。
【０００５】このような不具合を解消するため、始動時にのみ冷却水温度の代替値を低い値に設定することが考えられるが、この場合には、高温再始動時に機関の要求噴射量に対して実際の噴射量が極端に多くなるため、点火プラグのくすぶり等により始動が困難となる。更に、前述の従来技術のように、吸気温信号を水温信号の代替値に置き換えると、過給機付機関等の場合には、吸気温度が比較的高温まで上昇するため、冷却水温度に相当する過度の信号を得るのが難しく、機関状態に応じた燃料噴射を行うのが困難となる。
【０００６】そこで、特開平１－１００３４６号公報に開示されたように、エンジンが始動時であると判定された場合に水温センサからの入力値を始動時設定値とし、この始動時設定値を燃料噴射毎若しくは一定時間毎に微小な水温補正分ずつ始動後設定値に近づけた値に基づいて燃料噴射量を補正する一方、エンジンが始動後であると判定された場合に水温センサからの入力値を始動後設定値とし、この始動後設定値に基づいて燃料噴射量を補正するようにした技術が提案されている。
【０００７】
【発明が解決しようとする課題】しかしながら、上述のような従来技術にあっては、外気温度等の条件変化による暖機時間の変動には対処できず、燃料噴射量の補正ができない。又、一定の補正を行うため、運転条件によっては機関運転性の悪化が懸念される。
【０００８】更に、始動直後の水温センサ故障についても暖機後と判断するため、運転性の悪化が生じる。そこで、本発明は以上のような従来の問題点に鑑み、内燃機関における水温センサ故障時のフェイルセーフシステムにおいて、外気温度等の条件変化による暖機時間の変動にも対処できるようにして、燃料供給量の適切な補正を可能にすると共に、運転条件に依らず運転性の向上を図ることを目的とする。
【０００９】
【課題を解決するための手段】このため、請求項１に係る発明は、図１に示すように、機関回転数を検出する回転センサと、機関冷却水温度を検出する水温センサとを含む各部に配設した機関運転状態検出用のセンサからの入力信号に基づいて、燃料供給装置から機関への燃料供給量を調節するように構成された内燃機関において、前記水温センサの故障を検出する故障検出手段と、機関が始動時であるか始動後であるかを判別する機関状態判別手段と、前記回転センサと、水温センサ故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判

別信号に基づいて、機関始動時の水温センサ故障時に、水温センサからの入力値を始動時設定値に切り換えると共に、その直後から前記始動時設定値を燃料供給毎若しくは一定時間毎にアイドリング時の燃料供給量と機関回転数とから求められる微小な水温補正分ずつ暖機後水温相当の始動後設定値に近づけた値に補正する始動時水温設定手段と、前記故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判別信号に基づいて、機関始動後の水温センサ故障時に、故障前の水温が前記始動後設定値未満の際に前記補正を実行し、始動後設定値以上の際に始動後設定値に切り換える始動後水温設定手段と、を含んで構成した。

【００１０】

【作用】請求項１に係る発明において、水温センサの故障が検出された場合に、機関始動時であれば、水温センサの入力出力が始動時設定値に切り換えられる。そして、その直後から、前記始動時設定値に、燃料供給毎若しくは一定時間毎にアイドリング時の燃料供給量と機関回転数とから求められる微小な水温補正分ずつ加算され、その加算後の補正値が暖機後水温相当の始動後設定値に到達するまで、徐々に増加された各補正値に基づいて各回毎の燃料供給量が演算されることになる。即ち、冷却水温度に対応する補正分は、通常の燃料制御時の始動時の冷却水温に相当させた始動時設定値から機関が始動するまで徐々に変化されるため、燃料供給装置により燃焼室に供給される燃料供給量は、通常の始動時の燃料供給量と変わりない濃混合気から徐々にリーン側に減少されることになり、又、外気温度等の条件変化による暖機時間の変動にも対処できるようになり、燃料供給量の補正が可能となると共に、運転条件によって機関運転性が悪化する懸念もない。

【００１１】一方、機関始動後の水温センサ故障であれば、故障前の水温が前記始動後設定値未満の際には前記補正が実行され、始動後設定値以上の際には始動後設定値に切り換えられるため、燃料供給装置からの燃料供給量は車両の移動が行える程度に減量され、又、燃料供給量等を適正化でき、運転性の悪化が生じる虞がない。

【００１２】

【実施例】以下、添付された図面を参照して本発明を詳述する。図２は、自動車用のディーゼル機関を概略的に示したものである。この図において、機関１に装備された燃料供給装置としての電子制御式燃料噴射ポンプ２は、機関回転数を検出する回転センサとしての後述のクランク角センサ３と、機関冷却水温度を検出する水温センサ４とを含む各部に配設した機関運転状態検出用のセンサからの入力信号に基づいて、機関１への燃料噴射量を調節するように構成されており、この燃料噴射ポンプ２の駆動を制御するコントロールユニット５が設けられている。

【００１３】前記クランク角センサ３は、クランクシャフトに同期して作用する回転体６に対応して設けられている。前記水温センサ４は、機関冷却水温度に応じてアナログ電気信号を出力するように設定されている。この出力信号は、コントロールユニット５に入力されると共に、Ａ／Ｄ変換器を介してデジタル電気信号に変換される。

【００１４】前記クランク角センサ３は、機関１の回転速度に対応する信号を出力し、この出力信号はパルス信号としてコントロールユニット５に入力される。コントロールユニット５は、中央演算処理装置７と、記憶装置８と、入・出力インターフェース９，１０等を含んで構成される。入力インターフェース９には、水温センサ４からの信号と、クランク角センサ３からの信号及びその他のセンサからの信号が入力され、出力インターフェース１０からは、燃料噴射ポンプ２に向けて噴射信号が出力される。

【００１５】ここで、前記コントロールユニット５には、水温センサ４の故障を検出する故障検出手段と、機関１が始動時であるか始動後であるかを判別する機関状態判別手段と、前記回転センサ３、故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判別信号に基づいて、機関始動時の水温センサ故障時に、水温センサ４からの入力値を始動時設定値に切り換えると共に、その直後から前記始動時設定値を燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ずつ暖機後水温相当の始動後設定値に近づけた値に補正する始動時水温設定手段と、前記故障検出手段及び機関状態判別手段から夫々出力される検出信号及び判別信号に基づいて、機関始動後の水温センサ故障時に、故障前の水温が前記始動後設定値未満の際に前記補正を実行し、始動後設定値以上の際に始動後設定値に切り換える始動後水温設定手段と、の各機能が夫々ソフトウェア的に装備されている。

【００１６】かかるコントロールユニット５の制御内容を図３のフローチャートに基づいて説明する。先ず、ステップ１（図では、Ｓ１と略記する。以下同様）においては、水温センサ４からの水温情報を入力して、ステップ２に進む。このステップ２では、逐次入力される水温情報に基づいて水温センサ４が正常に作動しているか否かを判定する。具体的には、予め設定された故障判定値が所定回数以上連続して検出された場合には、水温センサ４の故障を判別し、検出されなければ、正常と判別する。故障と判定された場合は、ステップ３に進む。ステップ３では、始動時判定しているか否かを判定し、始動時判定していなければ、ステップ４に進み、クランク角センサ３から得られる機関回転数に基づいて機関始動時であるか始動後であるかを判定する。始動時であると判定されるとステップ５に進み、始動後であると判定されるとステップ６に進む。

【００１７】ステップ４にて始動時と判定された後のス

テップ５においては、水温センサ４からの入力値Ｔｗを始動時設定値ＫＴｗ１（例えば、４０°Ｃ）に切り換え（Ｔｗ＝ＫＴｗ１）、ステップ７に進む。このステップ７では、前記切り換えられた始動時設定値Ｔｗ（＝ＫＴｗ１）と始動後設定値ＫＴｗ２（例えば、８０°Ｃ）とを比較するが、ＫＴｗ１＜ＫＴｗ２であるから、ステップ８に進む。このステップ８では、前記始動時設定値Ｔｗ（＝ＫＴｗ１）を燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ΔＴｗずつ暖機後水温相当の始動後設定値に近づけた値に設定する（Ｔｗ＝Ｔｗ＋ΔＴｗ）。

【００１８】一方、ステップ４にて始動後と判定された後、即ち、始動後の故障時と判定された後のステップ６においては、水温センサ４からの入力値Ｔｗを故障前の水温センサ出力値Ｔｗ１に切り換え（Ｔｗ＝Ｔｗ１）、ステップ７に進む。このステップ７では、前記切り換えられた故障前の水温センサ出力値Ｔｗ（＝Ｔｗ１）と始動後設定値ＫＴｗ２とを比較し、故障前の水温が前記始動後設定値未満の際には（Ｔｗ＜ＫＴｗ２）、ステップ８に進んで前述した補正を実行し、始動後設定値以上の際には（Ｔｗ≧ＫＴｗ２）、ステップ９に進んで始動後設定値ＫＴｗ２に切り換える。

【００１９】又、ステップ３にて始動時判定していると判定された場合には、直接ステップ７に進む。尚、以上の制御は一定周期毎の割り込みルーチンであり、その算出結果は、メインルーチンにて燃料噴射量を算出する際に利用される。ここで、ステップ８の補正方法について説明する。

【００２０】このステップ８では、上述したように、始動時設定値を燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ずつ暖機後水温相当の始動後設定値に近づけた値に設定する。即ち、図４に示すようなＡやＢのアイドル回転数に基づいて、図５に示す始動からの時間経過に伴う予想水温の基準特性の傾斜を、ａ又はｂのように補正する。

【００２１】かかる構成によると、機関始動時の水温センサ故障時に、水温センサ４の入力出力が始動時設定値に切り換えられる。そして、その直後から、前記始動時設定値に、燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ずつ加算され、その加算後の補正値が暖機後水温相当の始動後設定値に到達するまで、徐々に増加された各補正値に基づいて各回毎の燃料噴射量が演算されることになる。即ち、冷却水温度に対応する補正分は、通常の燃料制御時の始動時の冷却水温に相当させた始動時設定値から機関が始動するまで徐々に変化されるため、燃料噴射ポンプにより燃焼室に供給される燃料噴射量は、通常の始動時の燃料噴射量と変わりない濃混合気から徐々にリーン側に減少されることになる。

【００２２】一方、機関始動後の水温センサ故障であれば、故障前の水温が前記始動後設定値未満の際には前記補正が実行され、始動後設定値以上の際には始動後設定値に切り換えられるため、燃料噴射ポンプによる燃料噴射量は車両の移動が行える程度に減量される。従って、かかる構成によれば、水温センサの異常が機関始動時に検出された場合に、冷間始動時から暖機始動時までの幅広い領域で燃料供給量が機関状況に適合して、確実に機関を始動させることができる。そして、水温センサの異常が機関始動後に生じた場合には、車両を移動させ得る程度の燃料を燃焼室に供給することができる。

【００２３】特に、かかる構成によると、水温センサの故障時かつ機関の始動時に、水温センサからの入力値を始動時設定値に切り換えた直後から始動時設定値を燃料噴射毎若しくは一定時間毎にアイドリング時の燃料噴射量と機関回転数とから求められる微小な水温補正分ずつ暖機後水温相当の始動後設定値に近づけた値に補正するようにした結果、外気温度等の条件変化による暖機時間の変動にも対処できるようになり、燃料噴射量の補正が可能となると共に、運転条件によって機関運転性が悪化する懸念もない。

【００２４】更に、機関始動後の故障時には、故障前の水温が始動後設定値未満の際に前記補正を実行し、始動後設定値以上の際に始動後設定値に切り換えるようにしたから、始動直後の水温センサ故障についても、燃料噴射量等を適正化でき、運転性の悪化が生じる虞がない。

【００２５】

【発明の効果】以上説明したように、請求項１に係る発明によれば、水温センサの異常が機関始動時に検出された場合に、冷間始動時から暖機始動時までの幅広い領域で燃料供給量が機関状況に適合して、確実に機関を始動させることができると共に、水温センサの異常が機関始動後に生じた場合には、車両を移動させ得る程度の燃料を燃焼室に供給することができ、特に、水温センサの故障時かつ機関の始動時に、外気温度等の条件変化による暖機時間の変動にも対処できるようになり、燃料供給量の補正が可能となると共に、運転条件によって機関運転性が悪化する懸念もなくなり、始動直後の水温センサ故障時についても、燃料供給量等を適正化でき、運転性の向上を図ることができる。

【図面の簡単な説明】

【図１】　請求項１に係る発明の構成図

【図２】　同上の発明の一実施例の概略図

【図３】　同上実施例の制御内容を説明するフローチャート

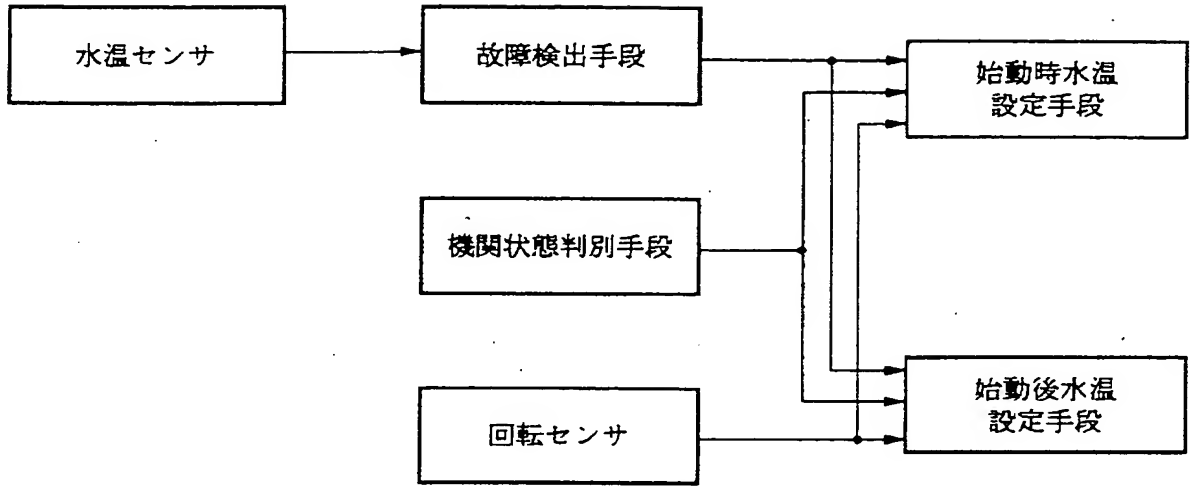
【図４】　機関始動時からの機関回転数変移を示す特性図

【図５】　機関始動時からの予測水温変移を示す特性図

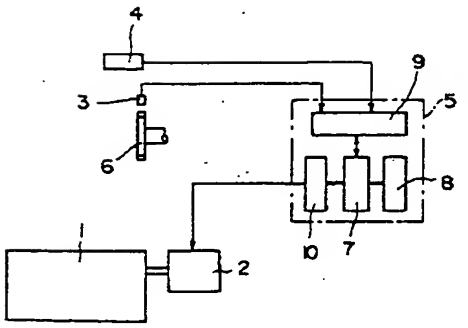
【符号の説明】

1　機関
2　電子制御式燃料噴射ポンプ
3　クランク角センサ
4　水温センサ
5　コントロールユニット

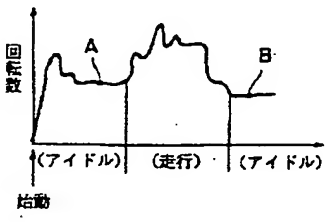
【図１】



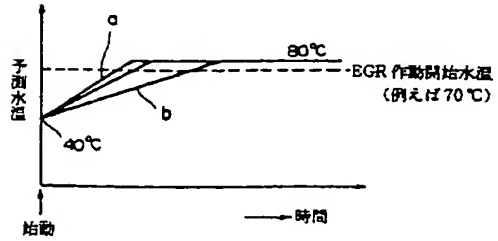
【図２】



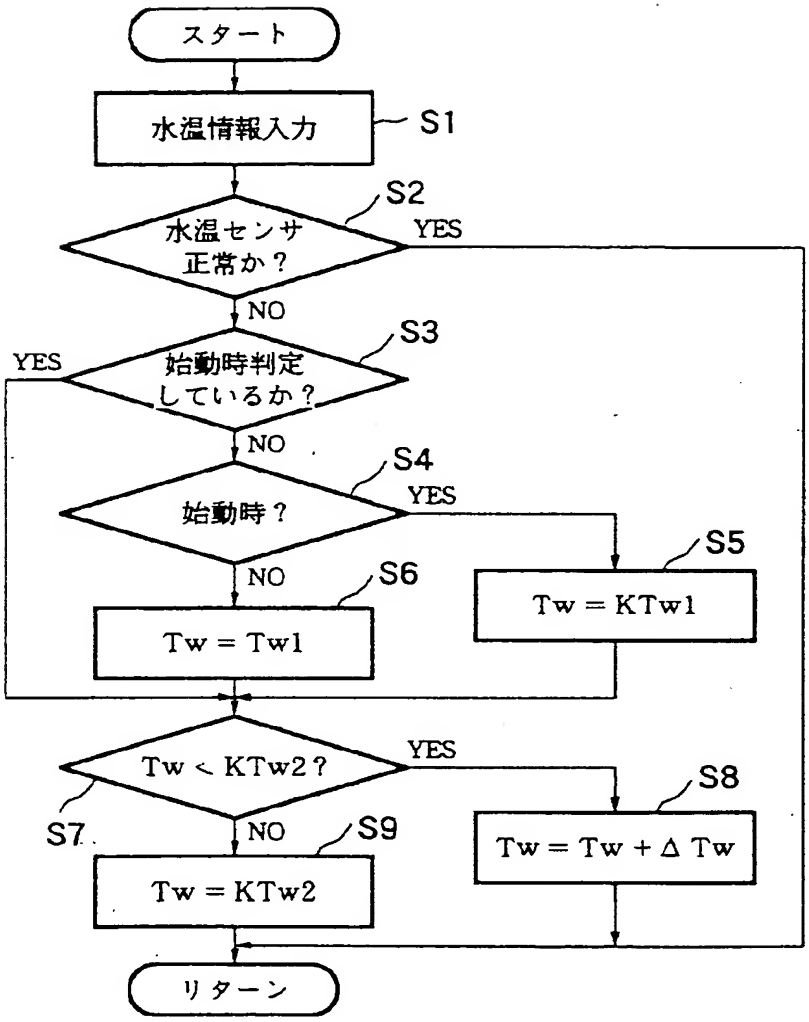
【図４】



【図５】



【図3】


スタート
水温情報入力
S1
S2
水温センサ
正常か？
YES
NO
S3
始動時判定
しているか？
YES
NO
S4
始動時？
YES
NO
S5
Tw = KTw1
S6
Tw = Tw1
Tw < KTw2？
YES
S7
NO
S8
Tw = Tw + Δ Tw
S9
Tw = KTw2
リターン